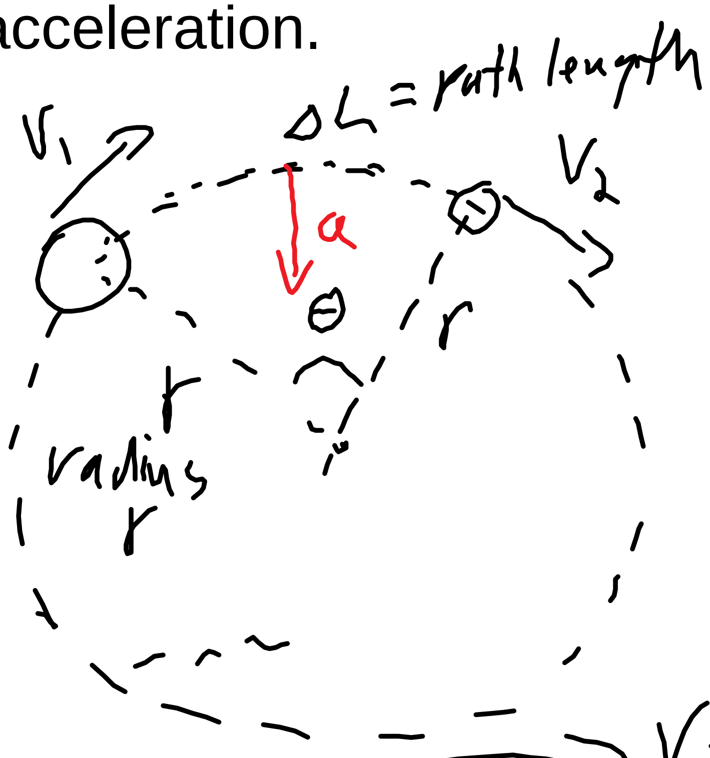
Tuesday, November 01, 2016 11:01 AM

Uniform Circular Motion

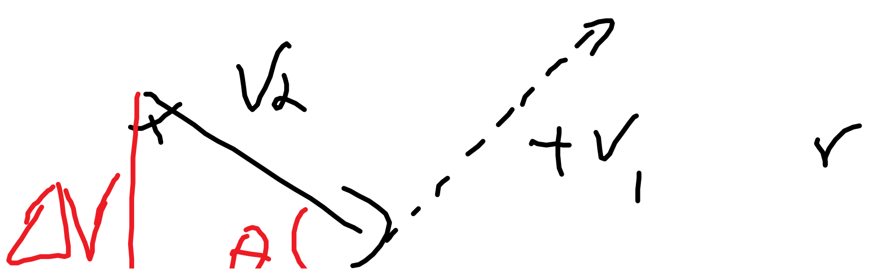
- constant speed motion in a circular path

object in motion will tend to move at constant speed in a straight line unless unbalanced forces act upon it. Therefore, an object in uniform circular motion must be experiencing a net force and an acceleration.



$$a = \frac{\Delta v}{\Delta t} = \frac{v_2 - v_1}{t}$$

vector subtraction



similar triangles

$$\frac{\Delta v}{v} = \frac{\Delta L}{r} \qquad \Delta v = \frac{v \Delta L}{r}$$

$$a = \frac{\Delta v}{\Delta t}$$

$$a = \frac{v \Delta L}{r \Delta t} \qquad v = \frac{\Delta L}{\Delta t}$$

$$a = \frac{v^2}{r} \qquad F_{net} = ma = \frac{mv^2}{r}$$

directed towards the centre

Valid for uniform circular motion

eg. 1. You drive a car at 20.0m/s around a

corner radius 40.0 m.

a) what is the acceleration of the car?

b) what is the net force on the 500.0 kg car?

c) what is the minimum coefficient of friction to keep the car from skidding?

d) you can slope the road to help cars go around corners. What angle of slope would best work for the above scenario?

2. You swing a bucket of water in a vertical plane.

a) what is the minimum speed of the bucket to keep the water from spilling out?

b) What is the force on 2.0 kg of water from the bucket i) at the top? ii) at the side iii) at the bottom if you are swinging the bucket with a radius of 1.40 m 2 revolutions per second.

Block 2-3

Uniform Circular Motion

- Constant speed in a circular path.

Note: not constant velocity because the direction changes.

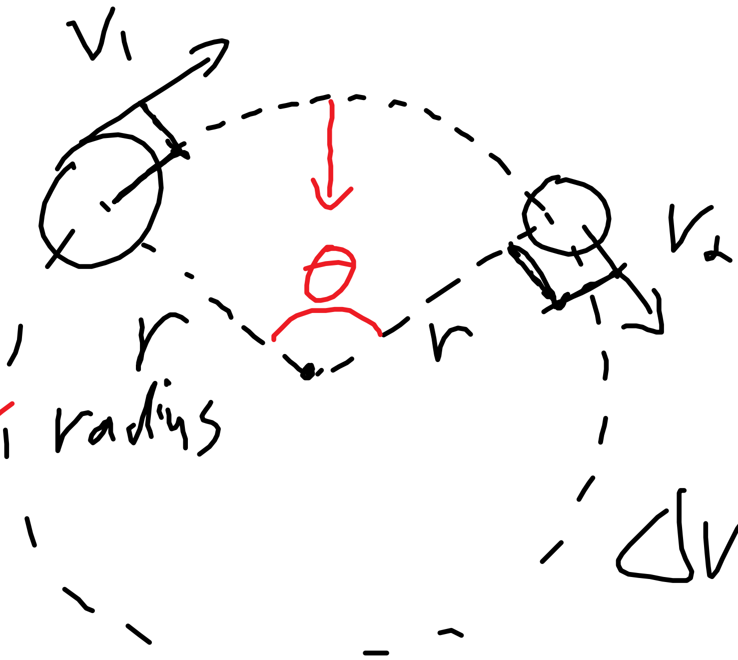
Law of inertia: objects tend to move at constant speed in a straight line unless unbalanced forces are applied.

Therefore, objects in uniform circular motion must be experiencing unbalanced forces, F_{net} and therefore there must be acceleration.

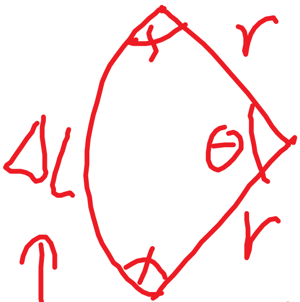
therefore there must be acceleration.

$$a = \frac{\Delta v}{\Delta t} = \frac{v_2 - v_1}{t}$$

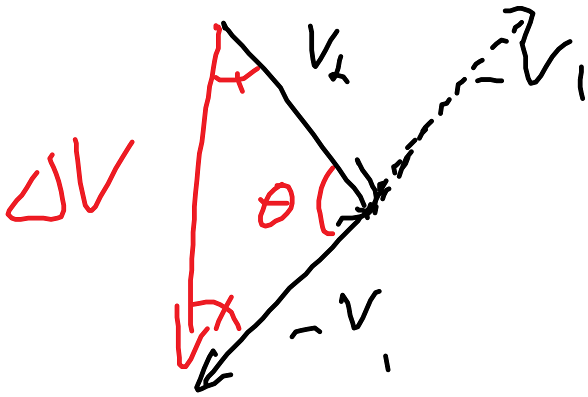
vector subtraction



$$\Delta v = v_2 - v_1$$



arc length, distance travelled



magnitude

$$v = |v_1| = |v_2|$$

$$\frac{\Delta L}{r} = \frac{\Delta v}{v} \rightarrow \Delta v = \frac{\Delta L\, v}{r}$$

$$a = \frac{\Delta v}{\Delta t} = \frac{\Delta L}{\Delta t} \frac{v}{r}$$

$\Delta L / \Delta t$ ← distance travelled / time $= v$ speed

$$a = \frac{v^2}{r}$$

$$F_{net} = ma = \frac{mv^2}{r}$$

only valid for constant speed

a and Fnet are towards the centre of the circle.

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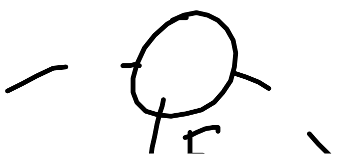
circumference

$$C = 2\pi r$$



$$v = \frac{C}{T}$$

$v = \frac{=}{T}$

↑ Period

frequency, $f = \frac{1}{T}$

$f = 42$ rpm

$v = \frac{42 \times C}{60s}$

$v = \frac{42 \times 2 \times \pi \times 0.13m}{60s}$

$v = \sout{2.6725 m/s}$

$0.57177 m/s$

$F_{net} = \frac{mv^2}{r} = F_f = \mu mg$

$\mu = \frac{v^2}{rg}$

$\mu = \frac{(\sout{2.6725}\ 0.57177)^2}{0.13(9.8)} = \boxed{0.26}$